

Geometric Calibration Verification Certificate

Digital Mapping Camera (DMC)

DMC Serial Number: **DMC01-0053**

CBU Serial Number: **0100053**

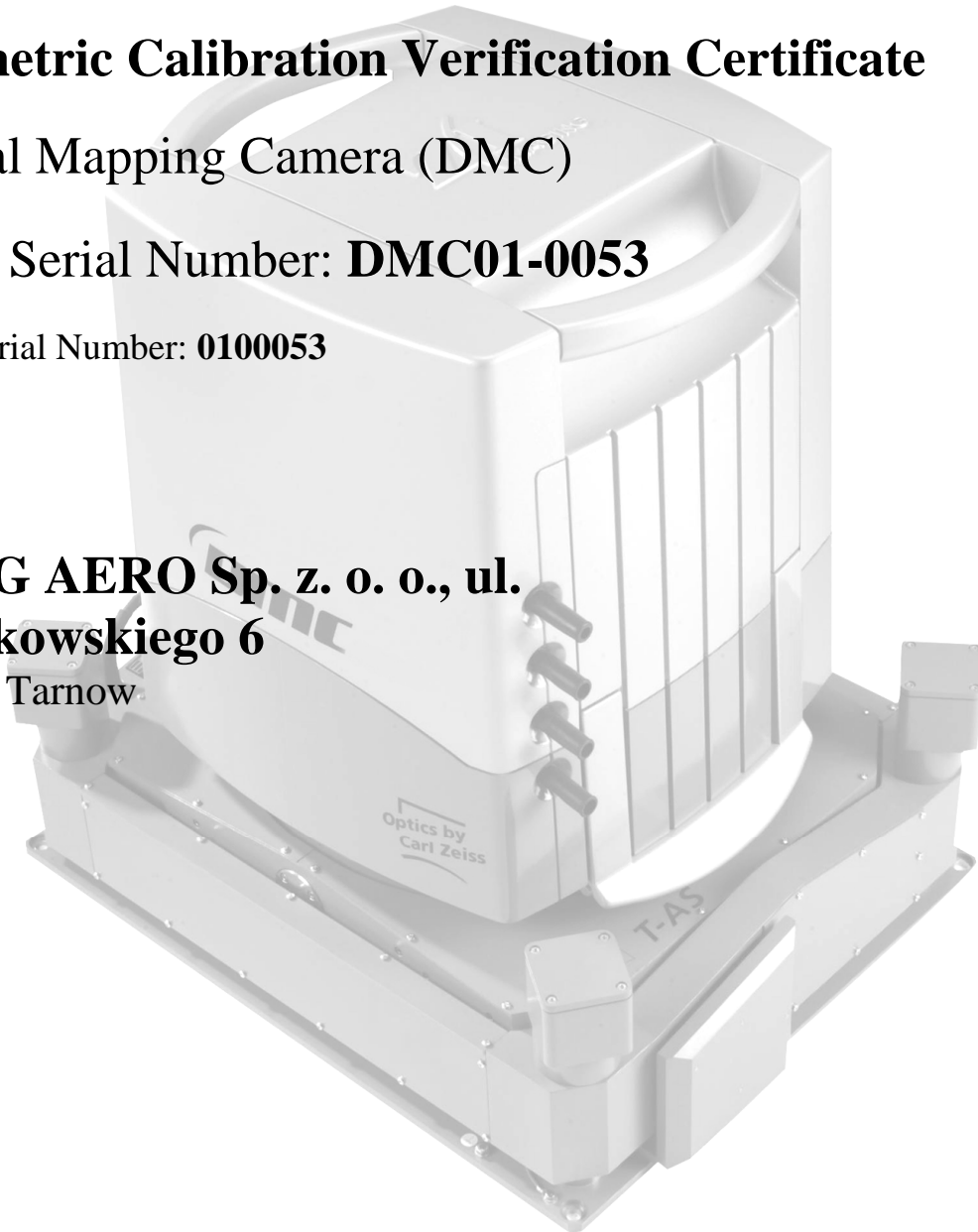
For

MPPG AERO Sp. z. o. o., ul.

Kaczkowskiego 6

33-100 Tarnow

Poland



System Overview

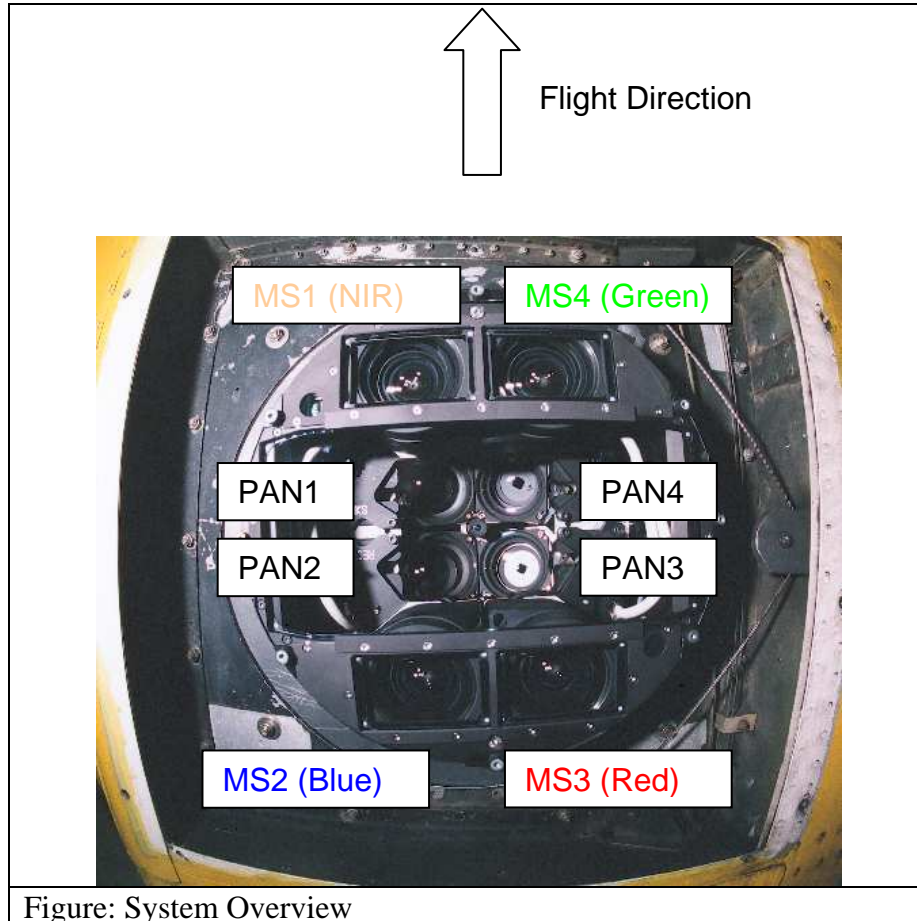


Figure: System Overview

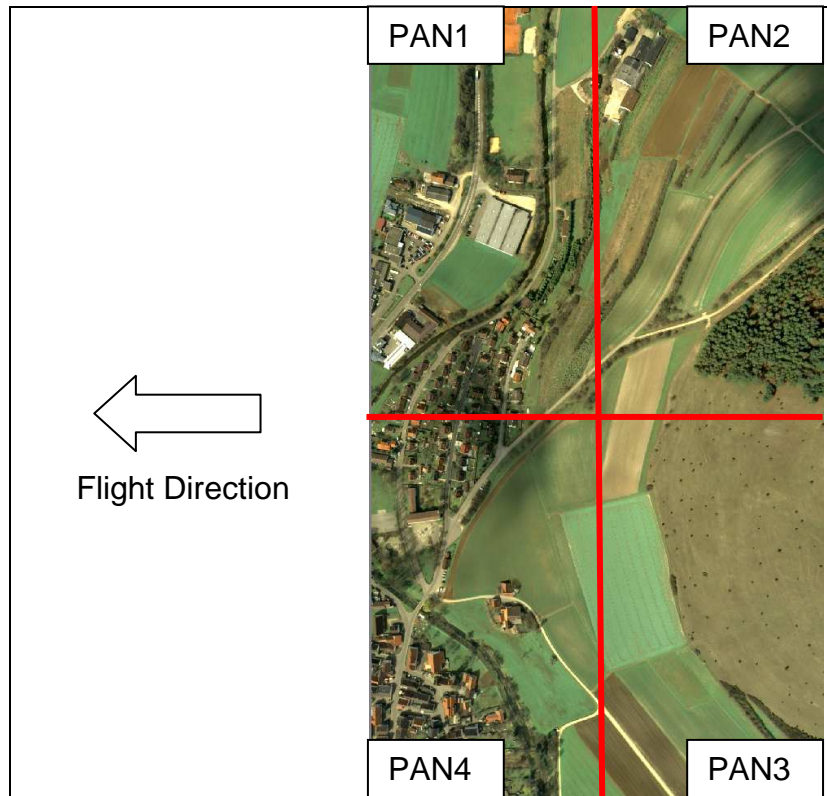


Figure: Image Overview (Pan Camera)

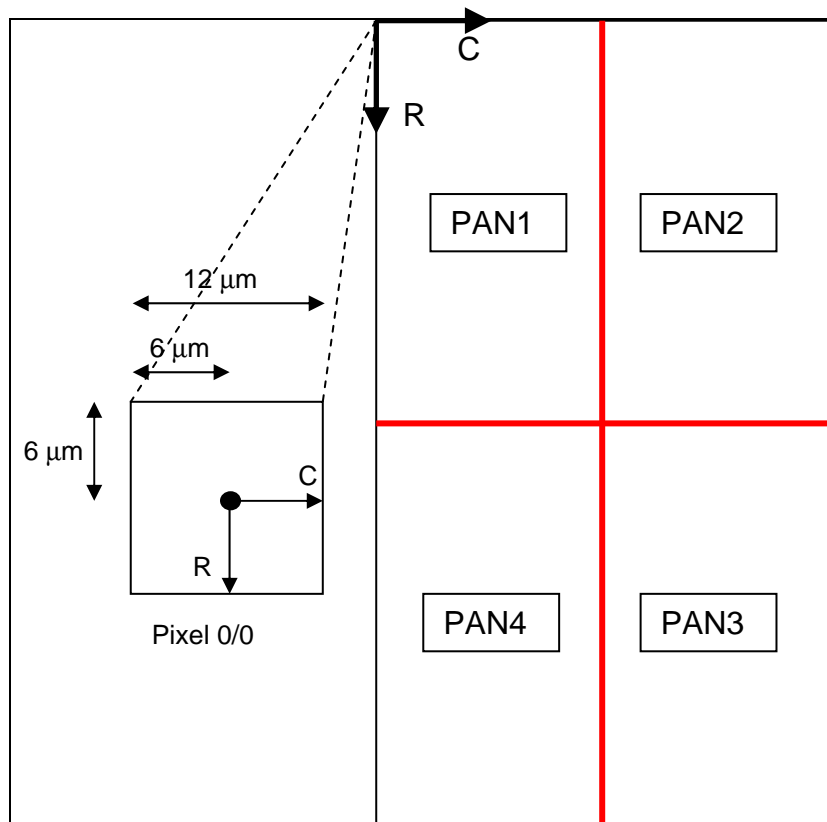


Figure: Image Coordinate System (Pan Camera)

Camera Parameter for Virtual Image (High Resolution)

Virtual Focal Length [mm]	120
Virtual Sensor Size [Pixel]	13824 x 7680
Virtual Pixel Size [μm]	12
Virtual Principle Point [mm]	$x_p = 0.0, y_p = 0.0$

Camera Parameter for Virtual Image (Color Resolution) before Version PPS 5.0.10.3

Virtual Focal Length [mm]	120 / 4.75
Virtual Sensor Size [Pixel]	3072 x 2048
Virtual Pixel Size [μm]	12
Virtual Principle Point [mm]	$x_p = -0.646, y_p = 0.646$

Camera Parameter for Virtual Image (Color Resolution) after Version PPS 5.1.10.3

Virtual Focal Length [mm]	30
Virtual Sensor Size [Pixel]	3456x1920
Virtual Pixel Size [μm]	12
Virtual Principle Point [mm]	$x_p = 0.0, y_p = 0.0$

Camera Serial Number and test flights

Camera	Serial Number	Calib. Date
Burn-in Flight: 21.05.2007		
Calibration Test Flight: 02.04.2009		
PAN1	00114289	13.12.2006
PAN2	00115722	14.02.2007
PAN3	00115726	12.02.2007
PAN4	00115778	29.01.2007
MS1 (NIR)	00115710	19.02.2007
MS2 (Blue)	00115818	14.02.2007
MS3 (Red)	00115823	14.03.2007
MS4 (Green)	00115715	14.02.2007

Camera Orientation PAN-Cameras (Test Flight 02.04.2009)

Camera (Serial Number)	X [m] (Standard Deviation)	Y [m] (Standard Deviation)	Z [m] (Standard Deviation)	Omega [Deg] (Standard Deviation)	Phi [Deg] (Standard Deviation)	Kappa [Deg] (Standard Deviation)
PAN1 (00117326)	0.064 (0)	-0.079 (0)	1000 (0)	18.002 (0.001)	10.057 (0.001)	86.773 (0.001)
PAN2 (00117329)	-0.064 (0)	-0.079 (0)	1000 (0)	17.899 (0.001)	-10.242 (0.001)	93.389 (0.001)
PAN3 (00117352)	-0.064 (0)	0.079 (0)	1000 (0)	-17.994 (0.001)	-10.049 (0.001)	-93.076 (0.001)
PAN4 (00117353)	0.064 (0)	0.079 (0)	1000 (0)	-17.905 (0.001)	10.234 (0.001)	-86.852 (0.001)

The data is connected to the virtual projection center of the virtual image.

The above Platform calibration values are initial values and are liable to slight fluctuations between project images and between different projects. The rotation axes of the angles are (in this order)

Omega	x-Axis
Phi	y-Axis
Kappa	z-Axis

The results of the Platform calibration were generated with DMC Postprocessing SW (PPS), Version 5.4 and later, from Intergraph Z/I Imaging photogrammetric product suite.

Platform calibration verification performed by:

Z/I Employ Name:


Dipl. Ing. Christian Müller

18.04.2009
Date

Aerotriangulation Results (Test Flight 02.04.2009)

	Photo Scale	1:6666
	Flying Height [m]	800
	Flying Altitude [m]	1000
	Run-Spacing [m]	774.1
	Base-Length [m]	245.8
	Number of Exposures	118
	Side-lap [%]	30
	End-lap [%]	60
	Terrain Height [m]	200
	Number of strips	6
	Photos in one strip	4 x 21 E-W 2 x 17 N-S
	Photos Used	118
	Control Points Used	35
	Check Points Used	
GSD [cm]	8 cm	

Statistic results:

Matching results: 0 Weak Areas - covered with clouds					
Whole Block	118 exposures used				
	0 exposures not used				
Whole Block	Sigma relativ:	2.312 um			
Whole Block	Sigma absolut:	2.373 um			
Whole Block					
Photo-T Parameters and Results for Project Calibfield_8cm					
PhotoT Triangulation Options					
Adjustment Mode	:	Absolute			
Precision Computation	:	Enabled			
Error Detection	:	Enabled			
Camera Calibration	:	Disabled			
Self-Calibration	:	Disabled			
Given EO/GPS	:	Disabled			
Antenna Offsets	:	Disabled			
GPS Shift/Drift Correction	:	Disabled			
INS Shift/Drift Correction	:	Disabled			
Parameters					
	Parameter	X/Omega	Y/Phi	Z/Kappa	XY
	RMS Control	0.040	0.046	0.039	0.043
	RMS Check				
	RMS Limits	0.080	0.080	0.120	
	Max Ground Residual	0.098	0.098	0.099	
	Residual Limits	0.100	0.100	0.150	
	Mean Std Dev Object	0.014	0.014	0.035	
	RMS Photo Position				



Geometric Calibration Verification
DMC01-0053



RMS Photo Attitude			
Mean	Std Dev	Photo Position	0.031 0.030 0.017
Mean	Std Dev	Photo Attitude	0.002 0.002 0.001

Key Statistics

Sigma: 2.4 um
Number of iterations: 2
Degrees of Freedom: 19965

The results of the Aerotriangulation were generated with ImageStation Automatic Triangulation (ISAT), Version 5.3 and later, from Intergraph Z/I Imaging photogrammetric product suite.

With this certificate we confirm that DMC [serial number] is within geometric accuracy.

Aerotriangulation performed by:

Z/I Employ Name:


Dipl. Ing. Christian Müller

23.04.2009

Date